

## IMPACT OF SOME MIXTURES BETWEEN RETARDANTS AND ANTIGRAMINACEOUS HERBICIDES ON THE SOWING PROPERTIES OF THE DURUM WHEAT SOWING-SEEDS

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**Abstract:** The research was conducted during 2010-2012 on pellic vertisol soil type. Under investigation was Bulgarian durum wheat cultivar Progress, which belongs to *Triticum durum* var. *leucurum*. Factor A included no treated check and 3 retardants – Stablan (chlormequat) – 2 l ha<sup>-1</sup>, Flordimex extra (ethephon) – 750 ml ha<sup>-1</sup>, Terpal (ethephon + mepiquat) – 3 l ha<sup>-1</sup>. Factor B included weeded no treated check and 3 antigraminaceous herbicides - Scorpio super 100 EK (phenoxaprop-ethyl) – 700 ml ha<sup>-1</sup>, Grasp 25 SK (tralkoxidym) – 1.2 l ha<sup>-1</sup>, Topik 080 EK (clodinafop) – 450 ml ha<sup>-1</sup>. All of retardants, herbicides and their tank-mixtures were treated in tillering stage of the durum wheat.

Tank mixtures of herbicide Grasp with retardants Flordimex extra and Terpal decrease germination energy of the durum wheat seeds. Tank mixture Stablan + Scorpio super decrease lengths of the primary roots and coleoptile. Investigated retardants, antigraminaceous herbicides and their tank mixtures decrease waste grain quantity. Tank mixture of herbicide Scorpio super with retardant Stablan not influences of waste grain quantity. The lowest grain yields are obtained by combinations of herbicide Scorpio super with retardants Stablan and Terpal and by combinations of herbicide Topik with retardants Flordimex extra and Terpal. The most increase of grain yield is obtained by combined use of retardant Terpal with herbicide Grasp, of retardant Flordimex extra with herbicides Grasp and Scorpio super and of retardant Stablan with herbicides Grasp and Topik.

**Key words:** durum wheat, retardants, herbicides, grain yield, sowing properties

### Introduction

In the future farming pesticides will be an effective tool for weed control as part of integrated control, which there is need for research to optimize their use (Kudsk and Streibig, 2003). The experience of their widespread use shows how important it is to consider all the factors that determine the effective implementation of these complex organic compounds. The main emphasis in the study of herbicides in durum wheat falls on their effect against the prevailing weeds and also on their selectivity on the culture. The main emphasis in the study of stimulators in durum wheat falls on their impact on productivity and quality of the grain to use as raw material in food industry (Baerg et al., 1996; Panwar et al., 1996; Kumar and Singh, 1997).

One of the important conditions for obtaining normal sown fields and a good harvest is the use of quality seeds. Furthermore, highly productive cultivar that has several conditions such as resistance to lodging, diseases and pests, the seeds must have

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the necessary sowing properties, the main of which are highly germinative energy and seed germination (Panayotov and Stoeva, 2000). Depending on soil and climatic conditions, lodging and seed attack from diseases and pests has been observed to obtain seeds with different germination (Wu et al., 1993; Bhaskara et al., 1998). In its determination should be recorded and the time when seeds in a rest after harvest. It varies depending on cultivar and condition in which the seeds were during the harvest.

These studies do not provide enough light to questions about the impact of mixtures between different pesticides on durum wheat.

Based on these data, we set the aim to determine the influence of some retardants, antigraminaceous herbicides and their tank mixtures on sowing properties of the durum wheat seeds and the quantity of waste grain.

### Material and methods

The research was conducted during 2010-2012 on pellic vertisol soil type. Under investigation was Bulgarian durum wheat cultivar Progress, which belongs to *Triticum durum* var. *leucurum*. It was carried out a two factor experiment as a block method in 4 repetitions, on a 20 m<sup>2</sup> harvesting area, after sunflower predecessor. Factor A included no treated check and 3 retardants – Stablan (chlormequat) – 2 l ha<sup>-1</sup>, Flordimex extra (ethephon) – 750 ml ha<sup>-1</sup>, Terpal (ethephon + mepiquat) – 3 l ha<sup>-1</sup>. Factor B included weeded no treated check and 3 antigraminaceous herbicides - Scorpio super 100 EK (phenoxaprop-ethyl) – 700 ml ha<sup>-1</sup>, Grasp 25 SK (tralkoxidym) – 1.2 l ha<sup>-1</sup>, Topik 080 EK (clodinafop) – 450 ml ha<sup>-1</sup>.

The weak adhesion of Grasp required its application with adjuvant Atplus – 1.2 l ha<sup>-1</sup>. All of retardants, herbicides and their tank-mixtures were treated in tillering stage of the durum wheat with working solution 200 l ha<sup>-1</sup>. Mixing was done in the spraying tank. Due to investigate herbicides have not antibroadleaved effect, the control of broadleaved weeds in all variants was done with herbicide Secator OD at dose 100 ml ha<sup>-1</sup>.

The grain gained after every variant was cleaned through a sieve with holes size 2.2 mm and the quantity of the waste grain was defined (siftings). All version seeds for sowing were defined for their germination energy and lab seed germination. It was studied intensity of early growth of seeds, expressed by the length of primary roots and coleoptile definite on the eighth day after setting the samples. Each index was determined in two repetitions per year. Averages in each of the years of experience were used as repetitions in mathematical data processing were done according to the method of analysis of variance.

### Results and discussion

One of the important conditions for obtaining a normal crop and a good harvest is the use of quality seeds. Apart from the high-yield cultivar which is resistance to diseases and pests, it must have the necessary sowing properties, the main of which are high germination energy and seed germination. Germination energy is one of the most important characteristics of the sowing properties of the seed. The low germination energy is the reason for slower development of primary roots and coleoptile after seed

germination and is associated with later germination in field conditions, less tempering of plants and a higher risk of frost in the winter. Its lead to lower grain yields. The obtained results show that the treatment of the durum wheat with tank mixtures of antigraminaceous herbicide Grasp with retardants Flordimex extra and Terpal during tillering stage of durum wheat lead to decrease in the germination energy (Table 1). In these tank mixtures germination energy of the seeds is less than that of the alone application of respective preparations. Analysis of variance, in which the years have taken for replications, shows that these decreases are mathematically proven compared to untreated control.

Table 1. Sowing properties of the seeds (mean 2010 - 2012)

Variants		Germinative energy (%)	Germination (%)	Length (cm)		Waste grain (%)
Retardant s	Herbicides			Coleoptile	Root	
-	-	86	94	11.27	15.80	14.1
	<i>Scorpio super</i>	89	97	13.81	17.89	11.1
	<i>Grasp</i>	86	97	13.13	18.28	11.0
	<i>Topik</i>	86	97	12.60	18.18	10.7
<i>Stabilan</i>	-	85	96	13.12	17.26	11.0
	<i>Scorpio super</i>	86	97	11.18	15.32	14.3
	<i>Grasp</i>	85	98	13.80	18.40	10.4
	<i>Topik</i>	85	97	13.55	18.02	10.1
<i>Flordimex extra</i>	-	85	96	11.69	17.31	12.3
	<i>Scorpio super</i>	86	98	12.65	17.88	11.3
	<i>Grasp</i>	81	96	12.77	17.55	11.1
	<i>Topik</i>	88	98	12.97	19.17	11.6
<i>Terpal</i>	-	87	97	13.05	18.00	11.6
	<i>Scorpio super</i>	88	99	13.40	18.72	13.1
	<i>Grasp</i>	82	99	13.35	18.62	11.4
	<i>Topik</i>	88	99	13.20	18.52	13.7
LSD 5%		3.0	3.1	3.1	3.8	2.0
LSD 1%		4.9	5.3	4.7	5.4	3.9
LSD 0.1%		7.1	7.8	6.5	7.7	5.8

Germination is the most important index who characterizing the sowing properties of the seed. At low laboratory germination sowing should be done with higher sowing rate, which increases the cost production. Laboratory germination of the seeds at all variant during the three years of study above the requirements of the standard for over 85 % germination, although in different years account for some variation of its values. The durum wheat seeds germinate normally by influence of the tank mixtures of herbicide Grasp with retardants Flordimex extra and Terpal, although the initial rate of development is lower due to lower germination energy. This can be regarded as a positive effect of their use, because it is not necessary to increase the sowing rate (in kg

ha<sup>-1</sup>) and the cost of necessary seeds. Other retardants, antigraminaceous herbicides increase the indexes germination energy and seed germination. Seed germination is the higher by tank mixtures of retardant Terpal with antigraminaceous herbicides Scorpio super, Grasp and Topik. It means that they help for joint and fast germination of the durum wheat sowing-seeds.

The obtained results for germination energy and seed germination are a prerequisite continue to investigate the effect of retardants, herbicides and their tank mixtures on initial intensity of the growth of seeds, expressed by the length of roots and coleoptiles. It was found that the length of coleoptiles of durum wheat is decreased by combinations between herbicide Scorpio super with retardant Stablan. The decreasing compared to alone application of these two preparations is proven by analysis of variants. This tank mixture difficult young plants developments, reduces their resistance to cold and increase risk of frost damages during winter months. Other tank mixtures between investigated retardants and antigraminaceous herbicides stimulate the growth of the length of primary roots and coleoptiles of the durum wheat and recommended for use in seed production crops of durum wheat.

At the evaluation of the sowing characteristics we have to consider not only the characteristics of the sowing seeds but also the quantity of the waste grain (siftings) which are gained at the preparation of these seeds. Bigger quantity screenings lead to higher cost of the seed and reduce the economic effect of seed production of durum wheat. Investigated retardants, antigraminaceous herbicides and their tank mixtures lead to decreasing in the quantity of waste grain. Differences between them and untreated control are mathematically proven. Only the tank mixture Stablan + Scorpio super does not decrease quantity of waste grain.

Decreases in the values of germination energy and laboratory seed germination, changes in the intensity of the initial growth, expressed by the length of the root and coleoptile at germination and changes in the quantity of waste grain by the influence of the combination between retardants and antigraminaceous herbicides are explained by the depressing effects on growth and development of the durum wheat during its vegetative period.

To make a full evaluation of the sowing properties needed to establish not only the quality of seeds, but also the quantity of grain which will be received this seeds. Data for the influence of retardants, antigraminaceous herbicides and their tank mixtures on grain yield (Table 2) show that the lower yield is obtained in untreated and weed control. The alone application of herbicides Scorpio super, Grasp and Topik increases grain yield because the weeds are destroyed. The alone application of retardants Stablan, Flordimex extra and Terpal also increases grain yields because they stimulate the growth and development of durum wheat, but the increase is less than in their mixtures with herbicides because present weeds neutralize a part of positive effect. Variant treated with retardant Flordimex extra, give the poor increase in grain yield compared to other retardants included in the experiment - 154 kg ha<sup>-1</sup> or 3.3 % more than the untreated control. These results confirm our previous studies (Delchev, 2004) that during drought ethephon based retardants, besides short of the plant height and also decrease grain yield of the durum wheat.

Table 2. Grain yield (2010 - 2012)

Variants		2010		2011		2012		Mean	
Retardants	Herbicides	kg/ha	%	kg/ha	%	kg/ha	%	kg/ha	%
-	-	3170	100	4004	100	4666	100	3947	100
	<i>Scorpio super</i>	3377	106.5	4297	107.3	5077	108.8	4250	107.7
	<i>Grasp</i>	3403	107.4	4350	108.6	4983	106.8	4246	107.6
	<i>Topik</i>	3420	107.9	4343	108.5	5061	108.5	4275	108.3
<i>Stabilan</i>	-	3390	106.9	4137	103.3	4943	105.9	4157	105.3
	<i>Scorpio super</i>	3317	104.6	3743	93.5	4877	104.5	3979	100.8
	<i>Grasp</i>	3437	108.4	4317	107.8	5135	110.1	4296	108.8
	<i>Topik</i>	3410	107.6	4230	105.6	5143	110.2	4261	108.0
<i>Flordimex extra</i>	-	3380	106.6	4100	102.4	4820	103.3	4100	103.9
	<i>Scorpio super</i>	3437	108.4	4467	111.6	5120	109.7	4341	110.0
	<i>Grasp</i>	3470	109.5	4343	108.5	5388	115.4	4400	111.5
	<i>Topik</i>	3447	108.7	3963	99.0	5066	108.6	4159	105.4
<i>Terpal</i>	-	3410	107.6	4161	103.9	4992	107.0	4188	106.1
	<i>Scorpio super</i>	3003	94.7	4467	111.6	5034	107.9	4168	105.6
	<i>Grasp</i>	3420	107.9	4503	112.5	5119	109.7	4347	110.1
	<i>Topik</i>	2893	91.3	4523	113.0	5104	109.4	4174	105.8
LSD 5%		159	5.0	125	3.1	160	3.4		
LSD 1%		214	6.8	169	4.2	215	4.6		
LSD 0.1%		284	9.0	223	5.6	285	6.1		

It was found that herbicide Scorpio super not be mixed with retardants containing chlormequat and mepiquat. Tank-mixtures of this herbicide with retardants Stabilan and Terpal in some years cause reduction in yield. In tank mixtures Scorpio super + Stabilan in 2011 and Scorpio super + Terpal in 2010 grain yield is lower even than in the untreated control by 6.5 % and 5.3 %. During the years of investigation in these tank mixes have also have antagonism, but in a much lesser degree. Grain yield is proved higher than control but unproven higher than in their alone application. In tank mixture of herbicide Scorpio super with retardant Flordimex extra containing only ethephon, there is an additive effect. In this tank mixture Scorpio super and Flordimex extra complement their action.

Herbicide Topik cannot be used with retardants containing ethephon or mepiquat. During drought conditions as in 2010 and 2011 there is an antagonism leading to a reduction in grain yield at tank mixtures of herbicide Topik with retardants Flordimex extra and Terpal. During cool and wet conditions after treatment period, as in 2012 there is not phytotoxicity. Antagonism at tank mixtures of herbicides Scorpio super and Topik with retardants is lead mainly to grain yield decreasing and less reduction in the herbicidal effect. At tank mixture Topik with Flordimex extra not reported manifestations of antagonism.

Herbicide Grasp show good miscibility with retardants Stabilan, Flordimex extra and Terpal. Their tank mixtures there are an additive effect in the three years of the investigation. Synergism is reported only in certain years with a favorable combination of temperature and rainfall.

### Conclusion

Tank mixtures of herbicide Grasp with retardants Flordimex extra and Terpal decrease germination energy of the durum wheat seeds.

Tank mixture Stabilan + Scorpio super decrease lengths of the primary roots and coleoptile.

Investigated retardants, antigraminaceous herbicides and their tank mixtures decrease waste grain quantity. Tank mixture of herbicide Scorpio super with retardant Stabilan not influences of waste grain quantity.

The lowest grain yields are obtained by combinations of herbicide Scorpio super with retardants Stabilan and Terpal and by combinations of herbicide Topik with retardants Flordimex extra and Terpal.

The most increase of grain yield is obtained by combined use of retardant Terpal with herbicide Grasp, of retardant Flordimex extra with herbicides Grasp and Scorpio super and of retardant Stabilan with herbicides Grasp and Topik.

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